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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/714,180	11/14/2003	Peter C. Rieke	50005-162	9390

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EXAMINER	
LEWIS, BEN	

ART UNIT	PAPER NUMBER
1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/714,180	RIEKE ET AL.	
	Examiner	**Art Unit**	
	Ben Lewis	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 14 August 2008.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-10, 13-29, 32-38, 96-101, 103-120 122-128 and 130-132 is/are pending in the application.

4a) Of the above claim(s) 96-101,103-108 and 111 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-10,13-29,32-38,96-101,111-120,122-128 and 130-132 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 14 November 2003 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2 Claim 17, 36 and 126 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The recitation of "said cathode layer comprises a substantially homogenous mixture of a copper-substituted ferrite material and a finely-divided form of a second material" in claims 17 and 36 is not present in the specification as originally filed.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-10, 15-19 and 112, 113, 115 rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997.)

With respect to claims 1,3, 4, 115, Aizawa et al. (US 6,692,855) teaches a solid oxide fuel cell for electrochemically reacting a fuel gas with an oxidant gas to produce a DC output voltage, said solid oxide fuel cell comprising a layer of ceramic ion conducting electrolyte defining first and second opposing surfaces, said electrolyte comprising a zirconium-containing material; a conductive anode positioned in contact with the first surface of said electrolyte layer; and a conductive cathode positioned in contact with the second surface of said electrolyte layer, said cathode comprising a modified lanthanum oxide material. The modified lanthanum oxide material is in direct contact with said zirconium-containing material; and wherein said fuel cell has a power density of at least about 1.0 W/cm^2 at 750°C and 0.7V. The reference does not teach a cathode comprising a modified lanthanum ferrite perovskite.

Kindermann et al. teaches a cathode material for a solid oxide fuel cell that produces electricity by electrochemically reacting a fuel gas with an oxidant gas to produce a DC output voltage, said solid oxide fuel cell comprising a layer of ceramic ion conducting electrolyte defining first and second opposing surfaces, said electrolyte comprising a zirconium-containing material; a conductive anode positioned is inherently in contact with the first surface of said electrolyte layer; and a conductive cathode

positioned in contact with the second surface of said electrolyte layer, said cathode comprising a modified lanthanum ferrite perovskite material; wherein said modified lanthanum ferrite perovskite material is in direct contact with said zirconium-containing material; and wherein said fuel cell includes a cathode layer of a perovskite composition having the formula:

$$La_{l-x-x'}Sr_xA'_{x'}Fe_{1-y-y'}M_yB'_{y'}O_3$$

wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the cathode material taught in Kindermann et al. in a fuel cell having the structure taught in Aizawa in order to reduce the SOFC fuel cell operating temperature and generate electricity (see Kindermann, p. 909, col. 1.) The reference does not teach copper as M, however based on the teachings of a variety of transition metals, one of ordinary skill in the art would be motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. Further, Aizawa teaches using copper as a dopant in a lanthanum perovskite material (see col. 18, lines 40-50.) The artesian would have found the claimed invention to be obvious in light of the teachings of the references.

With respect to claims 2 and 7, Aizawa et al. as modified by Kindermann et al. teach a fuel cell including a cathode layer of a perovskite composition having the formula:

$$La_{l\text{-}x\text{-}x'}Sr_xA'_{x'}Fe_{1\text{-}y\text{-}y'}M_yB'_{y'}O_3$$

wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant

With respect to claims 5 and 6, Aizawa et al. as modified by Kindermann et al. teach a fuel cell including a cathode layer of a perovskite composition having the formula:

$$La_{l\text{-}x\text{-}x'}Sr_xA'_{x'}Fe_{1\text{-}y\text{-}y'}M_yB'_{y'}O_3 \quad \text{(Sr A-site dopant)}$$

wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant

With respect to claims 8, 112-113, Kindermann et al. teach that M = Cr, Mn, Ni or Co (Pg 909 Col 2).

With respect to claims 9-10, Aizawa et al. as modified by Kindermann et al. teach a fuel cell including a cathode layer of a perovskite composition having the formula:

$$La_{l\text{-}x\text{-}x'}Sr_xA'_{x'}Fe_{1\text{-}y\text{-}y'}M_yB'_{y'}O_3$$

wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant The reference does not teach copper as M, however based on the teachings of

a variety of transition metals, one of ordinary skill in the art would be motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. Further, Aizawa teaches using copper as a dopant in a lanthanum perovskite material (see col. 18, lines 40-50.) The artesian would have found the claimed invention to be obvious in light of the teachings of the references.

The instant specification recites: The perovskite crystal structure of an A-site and B-site-substituted lanthanum ferrite perovskite is represented by the general formula: $La_{1-x} A_x B_y Fe_{1-y} O_3$. See Page 11, Lines 20-22. Aizawa et al. as modified by Kindermann et al. do not disclose any polarization resistance data. However, it is the position of the examiner that such properties are inherent, given that Aizawa et al. as modified by Kindermann et al. and the present application utilize the same copper-substituted lanthanum ferrite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 15 and 16, It is inherent that the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. comprises essentially the entire cathode layer since the cathode is made of the copper subsituted ferrite material of Aizawa et al. as modified by Kindermann et al. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is

necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

4. Claims 13-14, 32-33, 122 and 123 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997.) in view of Badding et al. (U.S. Pub. No. 2001/0044041 A1).

With respect to claims 13-14, 18, 32-33, 122 and 123, Aizawa et al. as modified by Kindermann et al. disclose a solid oxide fuel cell above. Aizawa et al. as modified by Kindermann et al. do not specifically teach wherein the copper substituted ferrite material comprises a layer having a thickness from about 1 tro 50 microns or having a thickness from about 1 to 30 microns. However, Badding et al. disclose high performance solid oxide electrolyte fuel cells (title) wherein With more conventional perovskite-type electrode materials such as $La_{0.85}Sr_{0.15}MnO_3$, or other manganites, electrode resistivity is typically about 10.sup.-2 ohm-cm, or essentially 3 orders of magnitude higher than the resistivities of precious metal-containing electrodes. In these cases the electrode designs generally involve smaller electrodes with shorter current path lengths (as low as 2 mm), higher electrode thicknesses, (>20 microns), and/or highly conductive current collectors in contact with the electrodes. Electrodes less than around 20 microns in thickness, however, are generally preferred for minimizing material usage and enhancing the flexibility and thermal shock resistance of the

electrode/electrolyte structure (Paragraph 0056). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the electrode thickness of Badding et al. for the cathode thickness of Aizawa et al. as modified by Kindermann et al. because Badding et al. teach that Electrodes less than around 20 microns in thickness, however, are generally preferred for minimizing material usage and enhancing the flexibility and thermal shock resistance of the electrode/electrolyte structure (Paragraph 0056).

5. Claims 1, 20-29, 32-38, 112-120, 124-125, 127-128 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Forthmann et al. (Ceramic coatings for cathode contacts of solid oxide fuel cells, Werkstoffwoche '98, Band II 1: Symposium 3, Werkstoffe fuer die Energretechnik; Symposium 7, Werkstoffe und Korrosion, Munich, Sept., 1998 (1999), Meeting Date 1998, 149-154 and further in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997.)

With respect to claims 1,3, 4, and 20, 23, 24, 25, 27, 37, 114, 115, 117, 118, 119, 127, 128, the teachings of Aizawa et al. (US 6,692,855) and Kindermann et al. have been presented. The reference does not teach a cathode comprising a modified lanthanum ferrite perovskite as claimed. Forthmann et al., however, teaches a cathode material for a solid oxide fuel cell that produces electricity by electrochemically reacting a fuel gas with an oxidant gas to produce a DC output voltage, said solid oxide fuel cell

comprising a layer of ceramic ion conducting electrolyte defining first and second opposing surfaces, said electrolyte comprising a zirconium-containing material; a conductive anode positioned is inherently in contact with the first surface of said electrolyte layer; and a conductive cathode positioned in contact with the second surface of said electrolyte layer, said cathode comprising a modified lanthanum ferrite perovskite material; wherein said modified lanthanum ferrite perovskite material is in direct contact with said zirconium-containing material; and wherein said fuel cell includes a cathode layer of a perovskite composition having the formula:

$$La_{1\text{-}x\text{-}x}\ Sr_{x}A'_{x},Fe_{1\text{-}y\text{-}y,}M_{y}B'_{y}\ O_3$$

wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant. The fuel cell cathode contact layer comprised a perovskite (LASK) La0.6,Srx0.4Fe0.8.Cuy0.203 (see the Abstract). Forthmann et al. teach that the (LASK) $La_{0.6}\ Sr_{0.4}\ Fe_{0.8}\ Cu_{0.2}\ O_3$ were sintered onto the interconnectors of the fuel cell stack (See abstract). Forthmann et al. teach interconnects with gas passages (See Fig. 2). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the cathode material taught in Forthmann et al. in a fuel cell having the structure taught in Aizawa as modified by Kindermann et al. in order to reduce the SOFC fuel cell operating temperature and generate electricity (see Kindermann, p. 909, col. 1 .) The amount of copper in the material is considered to be about 0.01 to about 0.05 because 0.2 is about 0.05." Further, it would have been obvious to one of ordinary skill in the art at,the time the invention was made to alter the amount of copper in the

material in order to achieve the desired properties of the stabilized material. Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation, In re *Aller, Lacey and Hall,* 105 U.S.P.Q. 233,235. The artesian would have found the claimed invention to be obvious in light of the teachings of the references.

With respect to claim 19, Forthmann et al. teach that the (LASK) $La_{0.6}Sr_{0.4}Fe_{0.8}Cu_{0.2}O_3$ were sintered onto the interconnectors of the fuel cell stack (See abstract).

With respect to claims, 28-29, Aizawa et al. as modified by Forthmann et al.. teach a fuel cell including a cathode layer of a perovskite composition having the formula: La_{l-x-}

$$La_{1-x-x'}Sr_xA'_{x'}Fe_{1-y-y'}M_yB'_{y'}O_3$$

wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant The reference does not teach copper as M, however based on the teachings of a variety of transition metals, one of ordinary skill in the art would be motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. Further, Aizawa teaches using copper as a dopant in a lanthanum perovskite material (see col. 18, lines 40-50.) The artesian would have found the claimed invention to be obvious in light of the teachings of the references.

The instant specification recites: The perovskite crystal structure of an A-site and B-site-substituted lanthanum ferrite perovskite is represented by the general formula: $La_{1-x} A_x B_y Fe_{1-y} O_3$. See Page 11, Lines 20-22. Aizawa et al. as modified by Forthmann et al.. do not disclose any polarization resistance data. However, it is the position of the examiner that such properties are inherent, given that Aizawa et al. as modified by Forthmann et al.. and the present application utilize the same copper-substituted lanthanum ferrite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 19 and 38, Forthmann et al. teach interconnects with gas passages (See Fig. 2).

With respect to claim 21, 116, Frothmann et al. teach that the fuel cell cathode contact layer comprised a perovskite (LASK) $La_{0.6} Sr_{0.4} Fe_{0.8} Cu_{0.2} O_3$ (See Abstract). Therefore the copper is present at 4 atomic percent. Examiner notes that copper is a B-site atom in the LASK formula of Frothmann et al.

With respect to claims 22 and 26, Frothmann et al. teach that the fuel cell cathode contact layer comprised a perovskite (LASK) $La_{0.6} Sr_{0.4} Fe_{0.8} Cu_{0.2} O_3$ (See

Abstract). Therefore the copper is present at 4 atomic percent. 4 atomic percent reads on “about 5 atomic percent.” Examiner notes that copper is a B-site atom in the LASK formula of Frothmann et al.

With respect to claims 34-35, It is inherent that the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. comprises essentially the entire cathode layer since the cathode is made of the copper subsituted ferrite material of Aizawa et al. as modified by Kindermann et al. A reference which is silent about a claimed invention’s features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 112-113, Kindermann et al. teach that M = Cr, Mn, Ni or Co (Pg 909 Col 2).

With respect to claims 120, Forthmann et al. disclose a planar solid oxide fuel cell characterized by 2 porous electrodes and a gas impermeable solid electrolyte. The fuel cell cathode contact layer comprised a perovskite (LASK) $La_{0.6}Sr_{0.4}Fe_{0.8}Cu_{0.2}O_3$ (See Abstract).

The instant specification recites: The perovskite crystal structure of an A-site and B-site-substituted lanthanum ferrite perovskite is represented by the general formula: $La_{1-x}A_xB_yFe_{1-y}O_3$. See Page 11, Lines 20-22. Forthmann et al do not

disclose any polarization resistance data. However, it is the position of the examiner that such properties are inherent, given that Forthmann et al and the present application utilize the same copper-substituted lanthanum ferrite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 124 and 125, It is inherent that the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. comprises essentially the entire cathode layer since the cathode is made of the copper subsituted ferrite material of Aizawa et al. as modified by Kindermann et al. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

6. Claims 130-132 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Forthmann et al. (Ceramic coatings for cathode contacts of solid oxide fuel cells, Werkstoffwoche '98, Band II 1: Symposium 3, Werkstoffe fuer die Energretechnik; Symposium 7, Werkstoffe und Korrosion, Munich, Sept., 1998 (1999), Meeting Date 1998, 149-154 and further in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997.)

With respect to claim 130-132, Aizawa et al. as modified by Forthmann et al. and Kindermann et al. disclose a planar solid oxide fuel cell characterized by 2 porous electrodes and a gas impermeable solid electrolyte. The fuel cell cathode contact layer comprised a perovskite (LASK) $La_{0.6} Sr_{0.4} Fe_{0.8} Cu_{0.2} O_3$ (See Abstract). Forthmann et al. also disclose perovskite $La_{0.6} Sr_{0.4} Fe_{0.8} Ni_{0.2} O_3$ (LSFN) (See page 150). Examiner notes the B site atom is Ni in (LSFN). Examiner also notes that Frothmann et al. also disclose perovskite LSM where the B site atom is Mn. Examiner also notes that Frothmann et al. disclose LSFC where the B site atom is Co (See page 150). The Frothmann reference does not teach wherein the electrolyte layer comprises a yttria-stabilized zirconium oxide, however Applicant teaches that Solid oxide fuel cells (SOFCs) employing a dense ceramic electrolyte are currently considered as one of the most attractive technologies for electric power generation. In a typical SOFC, a solid electrolyte separates the porous metal-based anode from a porous metal or ceramic cathode. Due to its mechanical, electrical, chemical and thermal characteristics, yttria-stabilized zirconium oxide (YSZ) is currently the electrolyte material most commonly employed. (Page 2 Applicant's Specification). Examiner notes that due to Applicants own admission of the use of yttria-stabilized zirconium oxide (YSZ) as an electrolyte material being well known in the fuel cell art it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the use of (YSZ) as an electrolyte material in the fuel cell of Forthmann et al.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben Lewis whose telephone number is 571-272-6481. The examiner can normally be reached on 8:30am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ben Lewis/
Examiner, Art Unit 1795

/PATRICK RYAN/
Supervisory Patent Examiner, Art Unit 1795